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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/943,189	08/30/2001	David L. Morris	P-7764.006	8496

7590 07/12/2004

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EXAMINER	
ROGERS, DAVID A	
ART UNIT	PAPER NUMBER
2856	

DATE MAILED: 07/12/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/943,189	MORRIS, DAVID L.	
	Examiner	Art Unit	
	David A. Rogers	2856	

-- Th MAILING DATE of this communication appears on the cover sheet with the correspondenc address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *23 January 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-49* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-49* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *23 January 2004* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. The applicant's arguments in response to the previous office action have been thoroughly considered. The Office appreciates the applicant clarifying the record with regard to the prior art. The previous rejection of the claims based on the 2nd paragraph of 35 U.S.C. 112 is withdrawn. Based on the applicant's response, the previous rejection of the claims under 35 U.S.C. 102(c) and 35 U.S.C. 102(f) is withdrawn. Based on the applicant's response, the claims previously rejected under 35 U.S.C. 103(a) is withdrawn. However, new rejections under 35 U.S.C. 112, 102(b), and 35 U.S.C. 103(a) follow. The applicant's arguments, therefore, are rendered moot in view of the new grounds of rejection. The Office apologizes for any inconvenience that this might cause the applicant.

Secondly, it is noted that the claims require only a "disposable coupon" with a burnished central surface (substrate) that is generally free of random, minute scratches. The phrase "generally free of random, minute scratches", despite being a limitation requested by the previous examiner, is interpreted herein to mean a surface that is roller burnished. This interpretation is supported by the instant application where it is stated:

> "The heater tube has a uniform and consistent work-hardened surface finish formed by burnishing. The finish is bright, smooth, and reflective and lacks the minute scratches." (Abstract)

and

> "The present invention provides a heater tube, and a process for manufacturing the same, that has a uniform and consistent work-hardened surface finish. This tube itself is

> substantially flat and generally free of the minute scratches resulting from other methods of finishing heater tubes." (Page 8, lines 6-9)

Furthermore, in accordance with the long standing practice of giving the terms of the claim their broadest, reasonable interpretation consistent with the specification, the term "disposable coupon" is interpreted as any article of manufacture that can be disposed of and is capable of being used in an analysis. See *In re Hyatt*, 211 F.3d 1367, 1372, 54 USPQ2d 1664, 1667 (Fed. Cir. 2000). See also *In re Schreiber*, 128 F.3d 1473, 44 USPQ2d 1429 (Fed. Cir. 1997)[1].

Finally, it is noted that it is well known that roller burnishing of parts enhances the fatigue life of those parts. See Japanese Patent Application Publication JP 10315051A to Naito. As such, components with roller burnished surfaces must be tested in order to determine the amount of improved fatigue life that was obtained. Therefore, "disposable coupons" with roller burnished surfaces must have been used in testing and analysis.

Response to Amendment

2. Acknowledgement is noted of the declaration of the inventor filed under 37 CFR 1.132 on 25 July 2003. The declaration of Mr. Morris primarily restates what is already disclosed in the application. This declaration is insufficient to overcome the rejection of claims 1-49 as presented herein below. While Mr. Morris may have had some difficulty in perfecting a roller burnished heater tube,

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[1] Prior art patent disclosing conical spout for open-ended containers, which contains all structural limitations recited in application claims for conical dispensing top for popped popcorn, anticipates application claims even though it does not address use of disclosed structure to dispense popcorn, since recitation of new intended use for old product does not make claim to that old product patentable, and since applicant's contention that claimed structure will be used to dispense popcorn thus does not have patentable weight if structure is already known, regardless of whether it has ever been used in any way in connection with popcorn.

this may be due in part to his stated inexperience with the art of roller burnishing (declaration, page 4, items 29, 30 where it is stated that burnishing is an "obscure" art to the inventor).

The applicant's item #42 from the declaration states "[a] heater tube that has been burnished has a slightly different, but insignificant, physical appearance..." It is assumed that the applicant meant "significant" vice "insignificant".

Drawings

3. Figures 1A, 2, and 3 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g).

Figure 1A is prior art as it is known to use light directed at the surface of a heater tube for the analysis of fuel deposits. See European Patent Application Publication EP 0660077A2 to Taylor. Figure 1B shows the reflection of light from a surface as performed by the applicant.

With regard to figure 2, the applicant, on at least three instances, admits that the present heater tube is the same as the prior art heater tube except for the forming of a roller burnished outer surface. See applicant's response received 04 February 2004, page 11 where it is stated (emphasis in original):

> "...the Examiner expresses sincere, but misplaced, concern that '[t]he primary, if not sole, difference between the claimed heater tubes and the known prior art heater tubes is the roller-burnished outer substrate.' Office Action at 8. **That's true.**"

See also applicant's response received on 31 July 2003, page 14 where it is stated:

> "Applicant's heater tubes are substantially identical in shape and size to prior art heater tubes which have been sold for over 20 years. Although physically different because of the burnished finish, Applicant's heater tube looks substantially similar to the prior art heater tubes without any magnification."

Finally, see applicant's disclosure, page 10, where it is stated:

> "FIG. 2 is a side view of one embodiment of a standard disposable heater tube 200 for use in fuel thermal stability testing apparatus. The dimensions and tolerances of the standard disposable heater tube 200 are constrained by the requirements of the commercially-available jet fuel thermal oxidation testers (JFTOTs) in which they are used. These JFTOTs have been sold for about thirty years and the dimensions of the disposable heater tubes have remained substantially the same throughout that time."

With regard to figure 3, see page 14 of the applicant's response submitted on 31 July 2003 where it is stated (emphasis added):

> "...burnishing machines are prior art to Applicant's invention. As set forth in the Rule 132 Declaration, Applicant obtained a prior art burnishing machine and used it in the conception and reduction to practice of his invention in 1999. In 1999 Applicant purchased the same used burnishing machine from a used machine dealer he had used in 1988-89 in his first failed attempt to reduce his invention to practice."

The applicant's only disclosed improvement of the burnishing machine is the addition of a power inverter (see disclosure, page 17), which is not shown in figure 3.

A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Claim Objections

4. Claim 14 is objected to because of the following informality. It is suggested that the applicant replace --deposable-- with --disposable-- on line 2.

5. Claims 1, 5-13, 15, 28, 30, 36, 40, 41, 47, 48 are objected to because of the following informality. It is requested that the applicant amend the claims to add the term --roller-- before the term --burnish-- in order that the claims be properly supported by the disclosure.

6. Claims 5, 6, 11, 12, 13, and 14 are objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. In this case a roller burnished surface, as in claim 1, inherently comprises a surface finish that is consistent, has uniform pattern of microscopic ridges and valleys, is flat enough to be cause incident light to substantially maintain its coherence, is flat enough to facilitate accurate measurements using an ellipsometer, and has a bright, smooth, highly reflective appearance that is work hardened.

7. Claim 32 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. In this case a roller burnished surface, as in claim 28 and 30, inherently comprises a surface finish that is work hardened.

Double Patenting

8. Applicant is advised that should claims 28, 30, 32, 34, and/or 48 be found allowable, claims 29, 31, 33, 35, and 49 will be objected to under 37 CFR 1.75 as

being a substantial duplicate thereof. When two claims in an application are duplicates or else are so close in content that they both cover the same thing, despite a slight difference in wording, it is proper after allowing one claim to object to the other as being a substantial duplicate of the allowed claim. See MPEP § 706.03(k).

Claim Rejections - 35 USC § 112

9. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

10. Claims 1-35 and 36-49 are rejected under 35 U.S.C. 112, first paragraph, as based on a disclosure which is not enabling. The omission in the claims of a "disposable coupon" with a surface free from residual burnishing marks and that is surface-finished by roller burnishing equipment rotating at a lower than a minimum rated rotational speed, which is critical or essential to the practice of the invention, but not included in the claim(s), is not enabled by the disclosure. See *In re Mayhew*, 527 F.2d 1229, 188 USPQ 356 (CCPA 1976).

In the instant application the applicant, on several occasions, states that the improved process is a result of the addition of a speed reduction means to the prior art roller burnishing equipment. See the applicant's declaration submitted under 37 C.F.R 1.132, statement items 25 (purchase of the exact same machine from 1989) and 41 (prior art machine purchased left residual rings). See also the applicant's response filed 31 July 2003 where it is stated that the purchased burnishing machine left residual marks, and the applicant's disclosure where the

sole improvement is the addition of the speed reduction means to eliminate the residual rings. The use of the speed reduction means is disclosed as resulting in a "disposable coupon" whose surface is not only free of random, minute scratches, i.e. roller burnished, but is also free of residual roller burnishing marks. These features, which the applicant discloses as being critical, are not claimed.

Claim Rejections - 35 USC § 102

11. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

12. Claims 1, 5, 6, 11-15, 20-22, 24, 26, 28, 29, 37, 38, 39 are rejected under 35 U.S.C. 102(b) as being anticipated by United States Patent 5,522,124 to Depperman.

Depperman discloses a machine tool (reference item 10) with a burnishing head assembly (reference item 14) for surface finishing, via roller burnishing, an elongated metallic article (reference item 54). Depperman also discloses that which is well-known in burnishing where it is stated:

> "Burnishing and bearingizing machines are used in a wide variety of applications to smooth cylindrical shaped work surfaces. Roller burnishing tools typically operate by using tapered rolls which rotate and bear on an inversely tapered mandrel to apply a steady rolling pressure against the work surface. This pressure causes high "peaks" in the surface of the metal workpiece to "flow" into the microscopic "valleys" present on the work

> surface. This provides extremely accurate sizing while simultaneously providing a very fine finish, as well as work hardening the part surfaces."

The metallic article will inherently be "generally free" of the random, minute scratches, as defined above. The metallic article inherently has a surface finish, i.e. a finish that is roller burnished, that is flat enough to cause incident light to substantially maintain its coherence when it reflects off the surface in order to facilitate substantially accurate measurements and calculations of fuel deposits using an ellipsometric tube analyzer.

13. Claims 1, 2, 4-9, 11-18, 20-22, 24, 26, 28, 29, 37, 38, and 39 are rejected under 35 U.S.C. 102(b) as being anticipated by Japanese Patent Application Publication JP 08197393A to Fujimoto *et al.*

Fujimoto *et al.* discloses the roller burnishing of an elongated metallic member (reference item 41) formed of aluminum such as 6063- or 3003-series alloys. Fujimoto *et al.* discloses that the burnishing equipment can provide a mirror-like surface wherein the median depth of the microscopic ridges can be down to less than 0.02 microns (20 nm). As noted above the term "disposable coupon" can be any metallic member capable of being used in an analysis. As noted above roller burnishing provides a work-hardened surface that is free of random, minute scratches and would inherently be flat enough to use with an analysis device such as an ellipsometer.

14. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –

> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

15. Claims 1, 4-22, 24, 26, 28, 29, 37, 38, and 39 are rejected under 35 U.S.C. 102(a) as being clearly anticipated by the applicant's admitted prior art.

The applicant, in his invention, uses a roller burnishing machine (see applicant's figure 3) that was purchased on the open market, and is the same machine that was used in 1988-1989 for burnishing heater tubes. See page 14 of the applicant's response submitted on 31 July 2003. Here the applicant states (emphasis added):

> "...burnishing machines are prior art to Applicant's invention. As set forth in the Rule 132 Declaration, Applicant obtained a prior art burnishing machine and used it in the conception and reduction to practice of his invention in 1999. In 1999 Applicant purchased the same used burnishing machine from a used machine dealer he had used in 1988-89 in his first failed attempt to reduce his invention to practice."

The applicant continues by stating that the difference between the experimental 1988-1989 efforts and the disposable coupon of the present invention is a burnished surface that is free from residual burnishing marks. The difference is not the degree of burnishing. See again page 14 where it is stated:

> "In 1988-89 Applicant was unable to keep the burnishing machine for [sic] leaving rings on the viewing portions of the test tubes which rendered the tubes commercially unacceptable."

The specific feature of a heater tube, as is known in the art, that is free of residual burnishing marks is not currently in the claims as written.

The burnishing machine used by the applicant, being admitted prior art, has the inherent capability to be used to obtain a disposable coupon with a surface finish where the median depth between the ridges and valley is less than

10 nm. The burnishing machine used by the applicant, being admitted prior art, has the inherent capability to be used to burnish the surface of a disposable coupon with a reduced diameter center portion. This is because burnishing macgines/mandrels are typically designed to finish the surface of an article of predetermined shape and/or size. See the reference to Elliott Tool Technologies for examples of roller burnishing tools for use with specific shapes of materials.

In all, it is not patentable to use an apparatus, i.e. the admitted prior art burnishing machine, to obtain a disposable coupon, i.e. a metallic member with a burnished surface, that would inherently be obtained by the normal/expected use of the apparatus.

Claim Rejections - 35 USC §103

16. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

17. Claims 2-4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Depperman as applied to claim 1 above, and further in view of Japanese Patent Application JP 409244286A to Takagi.

Depperman teaches an apparatus for roller burnishing an elongated metallic member. Depperman, however, does not expressly teach the roller burnishing of aluminum, 6061-T6 aluminum alloy, steel, brass, or titanium.

The apparatus Depperman has the inherent capability to burnish the outer surface of any member that is metallic. The use of any preferred metal for burnishing is based on the desired application of the metallic member. Takagi, for example, teaches that it is known to use a roller burnishing apparatus (reference item 1) to burnish the outer surface of a metallic tube (reference item 2). In this case, the tube is formed of an aluminum alloy.

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the teachings of Depperman with the teachings of Takagi in order to use a roller burnishing apparatus to burnish the outer surface of an metallic member made of aluminum, 6061-T6 aluminum alloy, steel, brass, or titanium.

18. Claims 1-29, 37-39, and 47-49 are rejected under 35 U.S.C. 103(a) as being unpatentable over United States Patent 5,101,658 to Wilson, III *et al.* in view of European Patent Application EP 0660077 A2 to Taylor, Fujimoto *et al.*, the applicant's admitted prior art, Depperman, and "Burnishing Products" to Elliott Tool Technologies (hereinafter referred to as Elliott).

Wilson, III *et al.* teaches an apparatus for determining the thermal stability of fuels, i.e. a jet fuel thermal oxidation test (JFTOT). In this test fuels are rated based on the amount of deposits that remain on a test surface. In particular Wilson, III *et al.* teaches that it is known to use a heater tube (reference item 42) in order to determine the thermal stability of fuels. As seen in figure 4, the tube is formed as an elongated member that has a reduced diameter central region

and non-reduced diameter distal ends. As stated in Wilson, III *et al.* (see column 6, lines 57-68) (emphasis added):

> "The heater tube 42 is generally of circular cross-section and of metallic construction. The type of metal utilized will be dependent upon the operating temperature involved in a specific test. While aluminum is preferred because of the low manufacturing costs, other metals such as stainless steel and titanium may be used if higher temperatures are required or it is desired to duplicate the metal of a specific end application. An important consideration in the manufacture of the heater tube 42 is that of obtaining a surface finish suitable for rating the level of fuel deposits thereon. Normally ***this requires a highly polished surface that can be accurately maintained with consistency so that deviations from tube to tube will be reduced to a minimum***. The deposition level can be either evaluated visually in comparison with a color standard, or by utilizing some other suitable means for sensing the level of deposits."

Taylor teaches that it is known to use an ellipsometry test in order to quantify the deposits on a disposable coupon, specifically a heater tube (reference item 5), resulting from a JFTOT analysis. This specific test, unlike the interferometric test commonly employed to rate fuels in a JFTOT analysis, can provide results of coating thickness less than 70 microns (70,000 nm) (column 1, lines 47-58). In particular, the ellipsometry test disclosed by Taylor is useful for measuring the thickness of the deposits from 0 to 600 nm, 0 to 250 nm, and even between 0 to 70 nm (column 2, lines 30-34). As an example, Taylor shows figure 4 where, in the tube region between 0 and 30 mm, there are measurements of film thickness on the order of 10 nm.

In order to obtain high accuracy readings of thickness between 0 and 20 nm using ellipsometry, the "highly polished surface" must be free of latent defects. Any latent defects, e.g. defects where the ridges and valleys present on the surface at the microscopic level cause the radiation directed at the surface to

diffuse, will result in erroneous readings, especially where the thickness of the deposits is within the same range as the surface roughness of the disposable coupon.

Fujimoto teaches that it is known that roller burnishing can provide a highly-polished, mirror-like surface on aluminum alloy tubes. The roller burnishing of Fujimoto *et al.* provides for a median depth of less than 20 nm.

The applicant admits that the burnishing apparatus used (see figure 3 of the applicant's disclosure) is prior art. See arguments presented above. The burnishing machine used by the applicant, being admitted prior art, has the inherent capability to be used to obtain an elongated, metallic disposable coupon with a surface finish where the median depth between the ridges and valley is less than 10 nm. Burnishing mandrels are typically designed and utilized for a specific purpose, as is well known and taught by both Depperman and Elliott. The burnishing machine used by the applicant, being admitted prior art, has the inherent capability to be used to burnish the surface of a disposable coupon with a reduced diameter center portion. With regard to claim 48 the process steps recited are the steps required to make the prior art burnishing apparatus operate. There are no steps involved that one of ordinary skill in the art would not have been aware of when using the prior art burnishing apparatus.

Depperman teaches an apparatus for roller burnishing an elongated metallic member. In particular, Depperman teaches a machine tool (reference item 10) with a burnishing head assembly (reference item 14) for surface finishing, via roller burnishing, an elongated metallic article (reference item 54).

Depperman also discloses that which is well-known in burnishing where it is stated:

> "Burnishing and bearingizing machines are used in a wide variety of applications to smooth cylindrical shaped work surfaces. Roller burnishing tools typically operate by using tapered rolls which rotate and bear on an inversely tapered mandrel to apply a steady rolling pressure against the work surface. This pressure causes high "peaks" in the surface of the metal workpiece to "flow" into the microscopic "valleys" present on the work surface. This provides extremely accurate sizing while simultaneously providing a very fine finish, as well as work hardening the part surfaces."

In Elliott there are shown numerous burnishing mandrels, each designed for a specific application such as inner bore burnishing, outer surface burnishing, inner diameter burnishing, etc. It is common knowledge that burnishing is useful for obtaining a highly polished, mirror-like surface. See Fujimoto *et al.* for support of this. Furthermore, Elliot teaches that burnishing

a) improves surface finish and results in dimensional accuracy;

b) will remove tool marks and surface irregularities;

c) can be used on materials such as brass, aluminum, steels, or bronze;

d) provides a work-hardened surface; and

e) can be used to simultaneously finish two or three diameters or surfaces with large interruptions.

The use of a specific metal, such as an aluminum alloy including 6061-T6 aluminum, is a mater of design choice. It is within the scope of one of ordinary skill in the art to form their disposable coupons of a material best suited to represent the environment to be replicated.

As stated in the MPEP § 2143.01, there are three possible sources for a motivation to combine references: the nature of the problem to be solved, the teachings of the prior art, and the knowledge of persons of ordinary skill in the art. In the present application, the prior art suggests to one of ordinary skill that

a) disposable coupons, such as the elongated tubes with a reduced diameter central portion, must have a highly polished surface and be free of defects (see Wilson, III *et al.*);

b) ellipsometry is commonly known to be used to measure deposit thickness to about 10 nm on disposable coupons, e.g. elongated tubes with reduced diameter central portions, that have been subjected to a JFTOT test (see Taylor);

c) a burnishing tool for use with small diameter, elongated members was available on the open market and is capable of burnishing a surface to about 10 nm (see applicant's admitted prior art);

d) roller burnishing of elongated members is known in the art and provides for a work-hardened surface with accurate sizing (see Depperman);

e) roller burnishing produces a highly polished surface that is free of defects (known benefit of burnishing as supported by Fujimoto *et al.* and Elliott); and

f) burnishing tools are designed for specific surface shapes (see Elliott).

Obtaining a disposable coupon with a burnished surface for use in the analysis of fuels would have been obvious, in view of the suggestions made and teachings in the prior art, in order to ensure that the disposable coupons provide

consistent results when used with current deposit thickness measuring techniques such as ellipsometry that measure down to about 10nm. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify the teachings of Wilson, III *et al.* with the teachings of Taylor, Fujimoto *et al.*, the admitted prior art, Depperman, and Elliott in order to provide a disposable coupon or a process to produce a disposable coupon comprising a burnished surface that is generally free of minute scratches.

19. Claims 30-~~33~~ 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wilson, III *et al.* in view of Taylor, Fujimoto *et al.*, the admitted prior art, Depperman, and Elliott as applied to claim 28 above, and further in view of United States Patent 5,540,883 to Jones *et al.*

Wilson, III *et al.* in view of Taylor, Fujimoto *et al.*, the admitted prior art, Depperman, and Elliott teaches that it is known to form disposable coupons with a burnished outer substrate. Furthermore, Elliott teaches that it is known to operate burnishing tools between 70 rpm and 1500 rpm (see Elliott, page 5). The applicant's admitted prior art burnishing tool also has a recommended operating range. Depperman and Elliott further teach that roller burnishing creates a work-hardened surface. However, Wilson, III *et al.* in view of Taylor, Fujimoto *et al.*, the admitted prior art, Depperman, and Elliott does not teach a mandrel that bears on the outer surface of the disposable coupon and operates at 100-300 rpm, a range that is less than the mandrel's rated speed of 700 rpm.

Jones *et al.* teaches that it is known in the art of roller burnishing to operate a burnishing tool at a speed substantially less than the recommended

setting (column 9, lines 11-17). In Jones *et al.* a bearing (reference item 20) has a bearing surface (reference item 22). The bearing is cold-rolled by a roller burnishing tool (reference item 50) to produce a densified layer (reference item 24). Furthermore, Jones *et al.* teaches that

> "particularly good results are achieved by adapting the burnishing tool 50 to present 3 rollers only and cold rolling and compressing the bearing surface 22 at a rate of approximately 20 - 30 RPM. The normal operation of the burnishing toll 50 is designed to operate with 7 rollers and at 800 RPM's."

It is clear from Jones *et al.* that it is known to operate a burnishing tool to burnish the outer surface of a metallic member at a speed lower than the rated speed. This is the same reason as to why the applicant reduces the speed of the burnishing tool from its recommended operating speed in the present invention. See also MPEP § 2144.05 where it is stated:

> " '[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation.' *In re Aller*, 220 F.2d 454,456,105 USPQ 233,235 (CCPA 1955)"

In the present application, the general conditions of operating a burnishing mandrel is well known. It is also well known to modify the preferred operating conditions of a burnishing mandrel so that it operates substantially slower than its rated speed in order to obtain superior results. As for the present case, discovering the optimal operating speed to burnish the outer surface in order to obtain the superior results is obvious over the prior art.

With regard to claims 34 and 35, the applicant admits that the prior art tubes are identical to the tubes of the present invention except for the presence of a burnished outer surface. See the discussion in the Drawings section above.

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the teachings of Wilson, III *et al.* in view of Taylor, Fujimoto *et al.*, the admitted prior art, Depperman, and Elliott with the teachings of Jones *et al.* in order to operate a burnishing tool at a speed of between 100 rpm and 300 rpm while drawing the disposable member through the tool.

20. Claim 36 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wilson, III *et al.* in view of Taylor, Fujimoto *et al.*, the admitted prior art, Depperman, Elliott, and Jones *et al.* as applied to claim 34 above, and further in view of United States Patent 6,332,652 to Nakakuro.

Wilson, III *et al.* in view of Taylor, Fujimoto *et al.*, the admitted prior art, Depperman, Elliott, and Jones *et al.* teaches that it is known to burnish parts using a machine whose speed is reduced from its recommended speed. The device of Jones *et al.* would inherently require some means for reducing and controlling the motor speed so that it operates slower than the rated speed. Wilson, III *et al.* in view of Taylor, Fujimoto *et al.*, the admitted prior art, Depperman, Elliott, and Jones *et al.* does not teach the use of an inverter for speed control.

Power inverters are quite common in the art and its use as a speed controller is well known. In order to show this, Nakakura teaches that it is known to utilize an inverter to control the speed of a motor.

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the teachings of Wilson, III *et al.* in view of Taylor, Fujimoto *et al.*, the admitted prior art, Depperman, Elliott, and Jones *et al.* with

the teachings of Nakakura to obtain a process to burnish disposable coupons comprising a burnishing machine with an inverter to reduce the speed of the burnishing machine from its recommended speed.

21. Claims 40-46 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wilson, III *et al.* in view of Taylor, Fujimoto *et al.*, the applicant's admitted prior art, Depperman, and Elliott.

Wilson, III *et al.* teaches a method for performing fuel testing using an apparatus for determining the thermal stability of fuels, i.e. a jet fuel thermal oxidation test (JFTOT). In this test fuels are rated based on the amount of deposits that remain on a test surface. In particular Wilson, III *et al.* teaches that it is known to use a hollow heater tube (reference item 42) in order to determine the thermal stability of fuels. As seen in figure 4, the tube is formed as an elongated member that has a reduced diameter central region and non-reduced diameter distal ends. As stated in Wilson, III *et al.* (see column 6, lines 57-68) (emphasis added):

> "The heater tube 42 is generally of circular cross-section and of metallic construction. The type of metal utilized will be dependent upon the operating temperature involved in a specific test. While aluminum is preferred because of the low manufacturing costs, other metals such as stainless steel and titanium may be used if higher temperatures are required or it is desired to duplicate the metal of a specific end application. An important consideration in the manufacture of the heater tube 42 is that of obtaining a surface finish suitable for rating the level of fuel deposits thereon. Normally ***this requires a highly polished surface that can be accurately maintained with consistency so that deviati ns fr m tube to tube will be reduced to a minimum***. The deposition level can be either evaluated visually in comparison with a color standard, or by utilizing some other suitable means for sensing the level of deposits."

In Wilson, III *et al.* fuel is passed over the outer surface of the heated tube so that deposits form on the surface. An evaluation of the deposits formed is performed in order to rate the fuels.

Taylor teaches that it is known to quantify the deposits on a heater tube (reference item 5) that result from a JFTOT analysis using an ellipsometry test. This specific test, unlike the interferometric test commonly employed to rate fuels in a JFTOT analysis, can provide results of coating thickness less than 70 microns (70,000 nm) (column 1, lines 47-58). In particular, the ellipsometry test disclosed by Taylor is useful for measuring the thickness of the deposits from 0 to 600 nm, 0 to 250 nm, and even between 0 to 70 nm (column 2, lines 30-34). As an example, Taylor shows figure 4 where, in the tube region between 0 and 30 mm, there are measurements of film thickness on the order of 10 nm.

In order to obtain high accuracy readings of thickness between 0 and 20 nm using ellipsometry, the "highly polished surface" must be free of latent defects. Any latent defects, e.g. defects where the ridges and valleys present on the surface at the microscopic level causes the radiation directed at the surface to diffuse, will result in erroneous readings, especially where the thickness of the deposits is within the same range as the surface roughness of the disposable coupon.

Fujimoto teaches that it is known that roller burnishing can provide a highly-polished, mirror-like surface on aluminum alloy tubes. The roller burnishing of Fujimoto *et al.* provides for a median depth of less than 20 nm.

The applicant admits that the burnishing apparatus used (see figure 3 of the applicant's disclosure) is prior art. See arguments presented above. The burnishing machine used by the applicant, being admitted prior art, has the inherent capability to be used to obtain an elongated, metallic disposable coupon with a surface finish where the median depth between the ridges and valley is less than 10 nm. Burnishing mandrels are typically designed and utilized for a specific purpose, as is well known and taught by both Depperman and Elliott. The burnishing machine used by the applicant, being admitted prior art, has the inherent capability to be used to burnish the surface of a disposable coupon with a reduced diameter center portion.

Depperman teaches an apparatus for roller burnishing an elongated metallic member. In particular, Depperman teaches a machine tool (reference item 10) with a burnishing head assembly (reference item 14) for surface finishing, via roller burnishing, an elongated metallic article (reference item 54). Depperman also discloses that which is well-known in burnishing where it is stated:

> "Burnishing and bearingizing machines are used in a wide variety of applications to smooth cylindrical shaped work surfaces. Roller burnishing tools typically operate by using tapered rolls which rotate and bear on an inversely tapered mandrel to apply a steady rolling pressure against the work surface. This pressure causes high "peaks" in the surface of the metal workpiece to "flow" into the microscopic "valleys" present on the work surface. This provides extremely accurate sizing while simultaneously providing a very fine finish, as well as work hardening the part surfaces."

In Elliott there are shown numerous burnishing mandrels, each designed for a specific application such as inner bore burnishing, outer surface burnishing,

inner diameter burnishing, etc. It is common knowledge that burnishing is useful for obtaining a highly polished, mirror-like surface (see Fujimoto *et al.*). Furthermore, Elliot teaches that burnishing

a) improves surface finish and results in dimensional accuracy;

b) will remove tool marks and surface irregularities;

c) can be used on materials such as brass, aluminum, steels, or bronze;

d) provides a work-hardened surface; and

e) can be used to simultaneously finish two or three diameters or surfaces with large interruptions.

As stated in the MPEP § 2143.01, there are three possible sources for a motivation to combine references: the nature of the problem to be solved, the teachings of the prior art, and the knowledge of persons of ordinary skill in the art. In the present application, the prior art suggests to one of ordinary skill that

a) disposable coupons, such as the elongated tubes with a reduced diameter central portion, must have a highly polished surface and be free of defects (see Wilson, III *et al.*);

b) ellipsometry is commonly known to be used to measure deposit thickness to about 10 nm on disposable coupons, e.g. elongated tubes with reduced diameter central portions, that have been subjected to a JFTOT test (see Taylor);

c) a burnishing tool for use with small diameter, elongated members was available on the open market and is capable of burnishing a surface to about 10 nm (see applicant's admitted prior art);

d) roller burnishing of elongated members is known in the art and provides for a work-hardened surface with accurate sizing (see Depperman);

e) roller burnishing produces a highly polished surface that is free of defects (see Fujimoto *et al.* and Elliott); and

f) burnishing tools are designed for specific surface shapes (see Elliott). Obtaining a disposable coupon with a burnished surface for use in the analysis of fuels would have been obvious, in view of the suggestions made and teachings in the prior art, in order to ensure that the disposable coupons provide consistent results when used with current deposit thickness measuring techniques such as ellipsometry that measure down to about 10nm.

With regard to claim 41, one would be motivated to clean the heater tube if the presence of dust, debris, or tool lubricating oil is found as a) it would ensure that the test results are valid and b) it would avoid the costly replacement of heater tubes that would have otherwise be rejected.

Therefore, in view of the above, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify the teachings of Wilson, III *et al.* with the teachings of Taylor, Fujimoto *et al.*, the admitted prior art, Depperman, and Elliott in order to provide a method for testing fuels using a disposable coupon comprising a burnished surface that is generally free of minute scratches.

Conclusion

22. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

a) Japanese Patent Application Publication JP 9-244286 A to Takagi teaches the roller burnishing of an elongated metallic member (reference item 2) using a burnishing mandrel comprising four equally-spaced rollers (reference item 1) and where the rollers are tapered.

b) "Roller Burnishing Tools - Operation Manual" to Mech-India teaches that, within roller burnishing, rotational speed is not critical, but higher than recommended speeds will reduce tool life. If long-length tools, or tools with extensive drive are used, speed should be reduced to prevent excessive whip.

c) "Roller Burnishing Tools" to Mech-India teaches additional well-known concepts of roller burnishing such as:

(1) obtaining a work-hardened surface;

(2) the use of inverse tapers for the rollers;

(3) the ability to obtain median depth of about 0.05 microns (50 nm);

(4) accurate sizing where part size can be changed as little as 0.002 mm;

(5) thousands of parts can be finished with little or no tool wear (such as 5 to 25 thousand parts);

(6) unskilled operators can produce close tolerance work with consistent part-to-part uniformity; and

(7) rotation at high speeds of the tool is not critical to the performance, high speed will produce the same burnishing result as low speed.

23. Any inquiry concerning this communication or earlier communications from the examiner should be directed to David A. Rogers whose telephone

number is (571) 272-2205. The examiner can normally be reached on Monday - Friday (0730 - 1600).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Hezron E. Williams can be reached on (571) 272-2208. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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07 July 2004

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PRIMARY EXAMINER